-continued

$$(\exists i|(E_b/I_o)_i \leqq \text{desired } (E_b/I_o)_i)$$

where i=the i^{th} mobile radio and ∃il signifies that there exists an i such that if the above is true, the mobile radio is told to increase its power.

After transmitting the first access probe at a minimum power level, the mobile radio increases the power of successive probes within each access probe sequence by a predetermined step amount. This step amount is different for different embodiments and is set to optimize the system performance.

A simplified block diagram of a typical mobile radio is illustrated in FIG. **5**. Signals received from the base station are received with the antenna (**501**). The duplexer (**502**) splits the signal to the low noise amplifier (**503**) that amplifies the signal. This amplified signal is then input to a variable gain amplifier (**504**), the gain of which is controlled by a receive automatic gain control circuit (**505**). The output of the variable gain amplifier (**504**) is input to a demodulator and decoder (**506**). The demodulator portion removes the signal modulation so that the packetized information can be broken up by the packet receiver (**507**) into a digital form that is usable by a computer or other electronic device.

A digital signal to be transmitted from a computer or other electronic device is first packetized (**520**). The packets of data are then modulated by the encoder and modulator (**525**). The modulated signal is input to a variable gain amplifier (**530**) that amplifies the signal prior to the fixed gain power amplifier (**535**). The output of the power amplifier (**535**) is input to the duplexer (**502**) that couples the signal to the antenna (**501**) to be radiated.

The gain of the variable gain amplifier is controlled by the power control bit of the present invention that is transmitted by the base station. When the mobile radio receives the power control bit, it is input to the closed loop power control circuitry (**540**). This circuitry (**540**) simply determines whether the power control bit is a logic 1 or a logic 0 and generates the proper control voltage to increase or decrease the gain of the variable gain power amplifier (**530**).

In the preferred embodiment, the gain is increased or decreased in 1 dB increments. The power control circuitry (**540**) outputs a digital value indicative of each 1 dB increase or decrease. This digital value is input to a digital to analog converter (DAC) (**545**). The DAC converts the digital value to an analog signal that controls the gain of the variable gain power amplifier. In this way, the process of the present invention enables the base station to dynamically adjust the transmit power of the mobile radio as conditions change.

Alternatively, the increase and decrease in gain does not have to be by the same amount. In addition, the increase and decrease in power control gain may adapt based upon the sequence of up or down commands that have been received by the mobile radio.

FIG. **6** shows a block diagram of a typical CDMA base station system incorporating the power control process of the present invention. This diagram shows the antennas of a base station (**601** and **602**) that receive the signals transmitted from the mobile radio. The received signals are distributed to various receivers (**605–620**) depending on which one is being used. The receivers (**605–620**) generate the demodulated bits for use by other devices such as external computers.

The receivers (**605–620**) also generate the signal to interference ratios, $^{Eb}/_{Io}$, that are used by the power control process of the present invention (**625**) to generate the power control bits. These bits are inserted into the power control stream by puncturing (**630**) the forward channel signal that has been generated by the modulator (**635**). This signal is then eventually transmitted by the transmit antenna (**603**) to the mobile radio.

In the preferred embodiment, the power control is performed by a single bit. Alternate embodiments, however, use multiple bits to form a power control command word. Such a word can not only control the direction of the transmit power but the rate of power change. For example, one bit of the command instructs the radio to increase power while another bit of the command instructs the increase to be in 2 dB increments instead of 1 dB.

In summary, the power control process of the present invention uses a single power control bit stream from the base station to control the transmit power of multiple radios. The signal quality metric, $^{Eb}/_{Io}$, is used to determine whether to increase or decrease the power and what amount of power change is needed.

I claim:

1. A method for controlling transmit power of a plurality of radios, the plurality of radios communicating with a base station, the method comprising the steps of:

the base station determining the transmit power required from each radio of the plurality of radios;

the base station instructing more than one of the plurality of radios to monitor a single power control bit stream; and

the base station transmitting said single power control bit stream to the more than one of the plurality of radios to instruct each of the more than one of the plurality of radios to alter its transmit power in response to the required transmit power.

2. The method of claim **1** wherein the step of determining the transmit power comprises the steps of:

determining a first signal quality threshold;

determining a second signal quality threshold;

determining a signal quality metric for each radio of the plurality of radios; and

comparing the signal quality metrics for the plurality of radios to the first and second signal quality thresholds.

3. The method of claim **2** wherein the signal quality metric is an energy per bit to total interference spectral density ratio.

4. The method of claim **2** and further including the steps of:

increasing the transmit power of a radio having a signal quality metric that is less than the first signal quality threshold; and

decreasing the transmit power of a radio having a signal quality metric that is greater than the second signal quality threshold.

5. The method of claim **2** wherein the first signal quality threshold is a minimum signal quality threshold and the second signal quality threshold is a maximum signal quality threshold.

6. A method for controlling a power output of a remote transmitter in a first mobile radio of a plurality of mobile radios, the first mobile radio receiving signals from a base station over a forward channel wherein said forward channel includes a first slot assigned to at least said first mobile radio and a second slot assigned to at least one other of said plurality of mobile radios, the base station receiving signals from the first mobile radio over a reverse channel, the method comprising the steps of:

determining a maximum reverse channel signal quality metric;